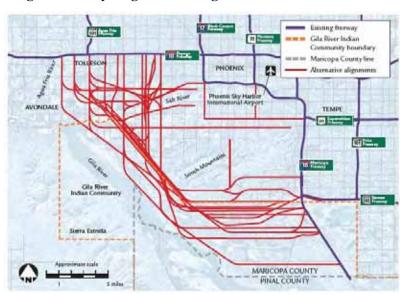


Technical Memorandum Summary E1 Alternative Initial Screening

INTRODUCTION

Alignments evaluated in the South Mountain Transportation Corridor Study were generated from previous studies, project team input, and routes provided from public input. Numerous alignments were identified in an initial effort requesting public preferences for freeway alignment locations that would contribute to creating a comprehensive set of alternatives. Figure 1 is a representation of the many alternatives the team considered in undertaking the initial screening.

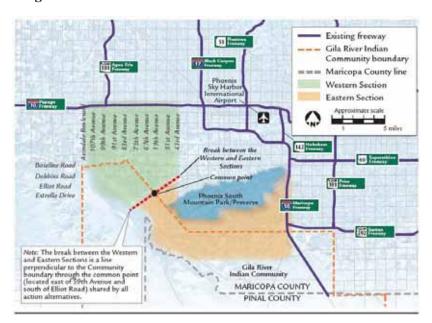
Figure 1. Early Alignment Siting Efforts



Early in the study process, the team arranged the study area into two areas, the Western and Eastern Sections. Figure 2 presents the extent of each section.

This technical memorandum summary documents the alternatives studied and eliminated from those initial alignments that were located in the Eastern Section of the study area. The team started with alignments in the eastern section that were located both north and south of Pecos Road. Because the Gila River Indian Community (Community) has not granted permission to ADOT to study alternatives within its land, all of those alignments were removed from further consideration. The alignments discussed in the following section are all outside of the Community boundary, with the exception of one. That one, the

Figure 2. Western and Eastern Sections



Riggs Road Alternative, is presented because numerous public comments have suggested the freeway be located along Riggs Road and 51st Avenue and, therefore, discussion is warranted.



Technical Memorandum Summary E1 Alternative Initial Screening

EASTERN SECTION ALTERNATIVES CONSIDERED BUT ELIMINATED

Nonfreeway Alternatives Considered but Eliminated

As a part of the screening process, prior to the consideration of any freeway alignments, nonfreeway alternatives individually and collectively were evaluated. Nonfreeway alternatives would provide transportation system improvements in the Study Area in lieu of a new freeway facility. A brief description of each alternative and reasons for eliminating the alternatives from detailed study are provided in Table 1.

Table 1. Nonfreeway Alternatives Eliminated from Further Study					
Alternative	Description	Reasons for Elimination			
Transportation	Would maximize the safety and efficiency of the existing				
system	transportation network using such traffic management				
management	tools as electronic message signs, signals to meter traffic				
(TSM)	flow at on-ramps, closed-circuit television cameras, and				
	vehicle detectors.				
Transportation	Would encourage reductions in travel demand in the				
demand	existing transportation network by promoting alternative				
management	modes of travel, including carpooling, van pooling,				
(TDM)	walking, bicycling, alternative work schedules and				
	compressed work schedules to reduce trips, and				
	telecommuting.				
Light rail	The first segment of the Central Phoenix/East Valley	These alternatives would			
	Light Rail Transit project is scheduled for completion in	have limited effectiveness			
	2008 through central Phoenix, northern Tempe, and	in reducing overall traffic			
	northwestern Mesa. As of 2006, while expansion routes	congestion in the Study			
	are being studied, none are being considered in the Study	Area and, therefore,			
	Area.	would neither meet			
Commuter rail	As of 2007, the region is not served by commuter rail. The	purpose and need criteria			
	Regional Transportation Plan (RTP) includes over 129	nor adequately address			
	miles of potential commuter rail corridors, but notes that	projected capacity and			
	"population densities sufficient to warrant investment in	mobility needs of the			
	commuter rail are seen as occurring beyond the 20-year	region.			
	planning horizon of the RTP." All active heavy rail track				
	in the region as of 2007 is used for freight purposes.				
Bus routes/	Express bus routes generally provide service to and from				
Van pools	"hubs" (e.g., park-and-ride lots, downtown city centers,				
van poois	major employment centers). Travel could be by freeway				
	or arterial street. Park-and-ride lots permit commuters to				
	park vehicles to take express buses. Van pools allow				
	groups of commuters to use community vans to commute				
	to and from work and function similarly to express bus				
	routes, but with fewer individuals participating.				
	Toutes, out with fewer individuals participating.				
	I.				



Technical Memorandum Summary E1 Alternative Initial Screening

Table 1. Nonfreeway Alternatives Eliminated from Further Study				
Alternative	Description	Reasons for Elimination		
Arterial street network expansion	Improvements to the arterial street network beyond those improvements planned in the RTP and in municipal general plans would occur under this alternative. Improvements could include adding more lanes to existing arterial streets, improving intersections, and creating new arterial street routes.	Based on projected regional travel demand and the extent of mobility needs of the region and within the Study Area, arterial street network improvements alone would not meet the purpose and need criteria.		

Notable observations from the analysis of nonfreeway alternatives include:

- TSM/TDM strategies are included in the RTP and will continue to be implemented throughout Maricopa County. Examples as to how elements of the TSM/TDM Alternatives would be implemented include the inclusion of ramp metering; overhead, automated, advanced warning signs; freeway cameras for monitoring traffic flow; and other intelligent transportation system technology to enhance operational characteristics.
- Funding for the expansion of transit modes in the region is included in the RTP. The modes being considered in the Study Area include light rail, commuter rail, and bus routes/van pools.
- Approximately \$1.4 billion of arterial street improvements in addition to planned freeway projects are included in the RTP over a 20-year period.

Parkway Alternative Considered but Eliminated

The parkway alternative would include the extension of existing Pecos Road to the west for approximately 1 mile and then northwest parallel to the Community boundary until connecting to 51st Avenue. The conversion to a parkway could include enhancements such as widening and grade separations. The alignment would cross through the ridges of Phoenix South Mountain Park/Preserve, requiring either large cuts or a tunnel. The reasons for eliminating the alternative include:

- The City of Phoenix has indicated it would not extend an arterial street through Phoenix South Mountain Park/Preserve to improve connectivity between southeastern and southwestern Phoenix.
- It would not provide the capacity needed to meet the projected capacity and mobility needs of the region.
- It would cause similar impacts as would a freeway alternative.

Freeway Alternatives Considered but Eliminated

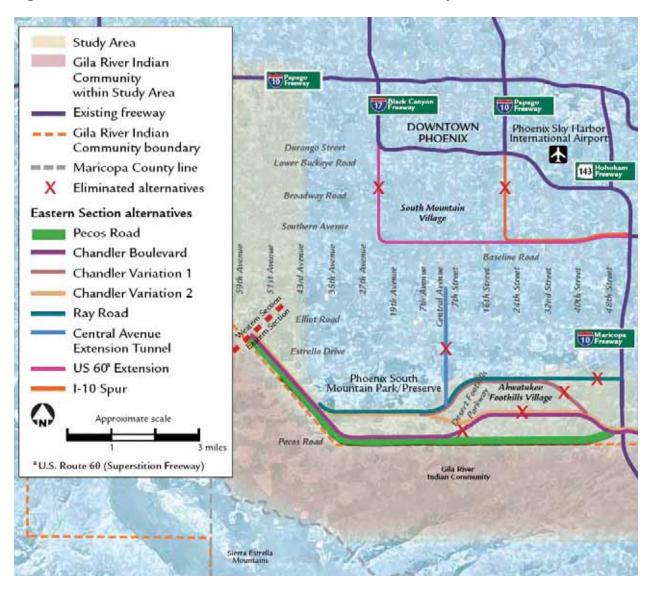
After eliminating the alignments that went through the Community and applying roadway design criteria, approximately eight freeway alternatives remained. The alternatives are displayed in the graphic below. Primarily because of the severity of projected community-related impacts (e.g., displacements and relocations, community character and cohesion), all but one of the freeway alternatives were eliminated from further study. Other factors (e.g., traffic operation, compliance with design standards, preliminary right-of-way requirements, conceptual cost estimates) supported the conclusion. A description of each alternative considered and the reasons for elimination are provided in the discussion that follows.



Technical Memorandum Summary
E1 Alternative Initial Screening

The remaining freeway alternative, the E1 Alternative (also known as the Pecos Road Alignment), would do the most to avoid, reduce, or otherwise mitigate community-related impacts on Ahwatukee Foothills Village. It would closely follow the published alignment adopted in the 1980s.

Figure 3. Eastern Section Alternatives Eliminated from Further Study



Ray Road Alternative

This alternative would replace the existing service interchange at Ray Road and I-10 with a new system interchange. It would then replace existing Ray Road to the west for approximately 4 miles before turning south and continuing west along Chandler Boulevard. At approximately 35th Avenue, the alternative would head northwest parallel to the Community boundary through the Phoenix South Mountain Park/Preserve.



Technical Memorandum Summary E1 Alternative Initial Screening

The reasons for elimination from further study include:

- Substantial impacts on traffic operation on I-10 (Maricopa Freeway) based on three system traffic interchanges within a 6-mile segment of I-10 (including I-10/SR 202L/Pecos Road, I-10/Ray Road Alternative, and I-10/US 60)
- Substantial impacts on existing residences, including a large number of residential displacements
- Substantial disruption to community character and cohesion, dividing Ahwatukee Foothills Village
- Loss of roadway network capacity by loss of a portion of Ray Road and Chandler Boulevard
- Impacts on commercial frontage along Ray Road and on residential developments
- Added cost to construct a new system traffic interchange and add capacity improvements along I-10 (in addition to what is already planned)

Chandler Boulevard Alternative and Chandler Variations

As shown in Figure 3, the Chandler Boulevard Alternative would begin at the existing I-10/Pecos Road system traffic interchange and immediately turn north to Chandler Boulevard. There, it would continue west and replace existing Chandler Boulevard for approximately 3 miles. At approximately Desert Foothills Parkway, the alternative would head southwest and follow the Pecos Road Alternative and parallel the Community boundary through the Phoenix South Mountain Park/Preserve.

Variation 1 would begin at the system traffic interchange and continue northwest until reaching Ray Road. From Ray Road, it would turn west and follow the same path as the Ray Road Alternative. It would replace portions of existing Ray Road and Chandler Boulevard.

Variation 2 would begin at the system traffic interchange and follow the Chandler Boulevard Alternative until Desert Foothills Parkway. At Desert Foothills Parkway, instead of heading southwest, Variation 2 would remain on existing Chandler Boulevard. Variation 2 would continue west until approximately 35th Avenue, where it would head northwest parallel to the Community boundary through the Phoenix South Mountain Park/Preserve.

The reasons for elimination from further study include:

- Substantial impacts on existing residences, including a large number of residential displacements
- Substantial disruption to community character and cohesion, dividing Ahwatukee Foothills Village
- Impacts on commercial frontage along Chandler Boulevard and on developments
- Loss of roadway network capacity by loss of portions of Chandler Boulevard and Ray Road

US 60 Extension Alternative

This alternative would begin at the I-10/US 60 system traffic interchange and serve as a western extension of US 60. The freeway alignment would parallel Baseline Road approximately ½-mile north for 6 miles, from 40th Street to 19th Avenue. Just west of 19th Avenue, the alignment would turn north for approximately 3 miles and connect to I-17 with a system traffic interchange west of 19th Avenue.



Technical Memorandum Summary E1 Alternative Initial Screening

The reasons for elimination from further study include:

- Failure to satisfy the purpose and need for the project
 - Substantial traffic operational impacts on I-10 (Maricopa Freeway) between SR 202L (Santan Freeway) and US 60 (Superstition Freeway); would worsen current severe congestion along this stretch of I-10
 - Increased undesirable congestion on US 60 (Superstition Freeway) and SR 101L (Price Freeway)
 - O Unplanned for underuse of the SR 202L (Santan Freeway)
- Substantial impacts on existing developments, including thousands of residential displacements
- Would require extensive improvements not included in current plans for US 60, I-10, and I-17
- Substantial disruption to community character and cohesion, dividing South Mountain Village

I-10 Spur Alternative

This alternative begins along the same alignment of the US 60 Extension Alternative but turns north just west of 24th Street and connects to I-10 at the I-17/I-10 system traffic interchange.

The reasons for elimination from further study include:

- Failure to satisfy the purpose and need for the project
 - Substantial traffic operational impacts on I-10 (Maricopa Freeway) between SR 202L (Santan Freeway) and US 60 (Superstition Freeway); would worsen current severe congestion along this stretch of I-10
 - Increased undesirable congestion on US 60 (Superstition Freeway) and SR 101L (Price Freeway)
 - Unanticipated for underuse of SR 202L (Santan Freeway)
- Substantial impacts on existing developments, including thousands of residential displacements
- Would require extensive improvements not included in current plans for US 60, I-10, and I-17
- Substantial disruption to community character and cohesion, dividing South Mountain Village

Central Avenue Extension Tunnel

This alternative would connect Baseline Road to Chandler Boulevard by extending Central Avenue through the South Mountains. The alternative would be approximately 4 miles long and include a 2.5-mile-long tunnel.

The reasons for elimination from further study include:

- Failure to satisfy project purpose and need criteria
 - Minimal improvement to traffic operation along I-10 (Maricopa Freeway) and regional mobility
 - o Alternative would be an unplanned extension of Central Avenue and would not adequately address capacity deficiencies in the region
- A tunnel under Phoenix South Mountain Park/Preserve would be up to 2.5 miles long and would be cost-prohibitive, undesirable for safety and emergency response, result in direct use of a resource afforded protection under Section 4(f), and result in disproportionately high construction costs considering the percentage of vehicular trips served



Technical Memorandum Summary E1 Alternative Initial Screening

Avoidance alternatives considered but eliminated

As a part of the Section 4(f) evaluation, two alternatives that completely avoid the Section 4(f) resources associated with the South Mountains were also considered. The alternatives, as well as the reasons for their elimination from further study, are described below.

Riggs Road Alternative

The Riggs Road Alternative (see Figure 4) would replace 51st Avenue south of its connection to I-10 for approximately 21 miles. It would then replace approximately 4 miles of Beltline Road in an easterly direction. At the Riggs Road/SR 347 intersection, the alternative would replace approximately 3 miles of Riggs Road before connecting to I-10 at the existing I-10/Riggs Road service traffic interchange.

Reasons for elimination from further study include:

- Nearly two-thirds of the alternative would be on Community land
- The alternative would not meet a purpose of the project—to support optimization of the regional transportation network; therefore, the alternative would not meet the project's purpose and need criteria

SR 85/I-8 Alternative

The SR 85/I-8 Alternative (see Figure 5) would begin at I-10 approximately 32 miles west of downtown Phoenix and would either replace or widen SR 85 for approximately 33 miles south before connecting to I-8 in Gila Bend. The alternative would then replace or widen I-8 for approximately 63 miles east before reconnecting with I-10 at Casa Grande, approximately 56 miles south of downtown Phoenix. SR 85 is currently being reconstructed as a four-lane, divided highway with limited-access control, and I-8 is a four-lane, divided Interstate freeway with full access control. Existing signs at each terminus designate the route as a truck bypass of downtown Phoenix.

Reasons for elimination from further study include:

 The alternative would not meet a purpose criterion for the project—to support regional traffic mobility

Figure 4. Riggs Road Alternative



Figure 5. SR 85/I-8 Alternative





Technical Memorandum Summary E1 Alternative Initial Screening

CONCLUSION

The E1 Alternative (Pecos Road Alignment) is the only alternative being carried forward in the Eastern Section for the following reasons:

- The E1 Alternative would result in the least amount of impact to the adjacent community
 - Would reduce the number of residential displacements
 - Would not bisect Ahwatukee Foothills Village as would be the case with the Ray Road or Chandler Boulevard Alternative and Variations
- The E1 Alternative would meet the purpose and need criteria for the project by providing a transportation corridor that optimizes traffic operation of the regional freeway system
- The E1 Alternative would be located outside of the Gila River Indian Community



Technical Memorandum Summary
E1 Alternative Initial Screening
Profile Options Along Pecos Road Section

INTRODUCTION

E1 Alternative Description

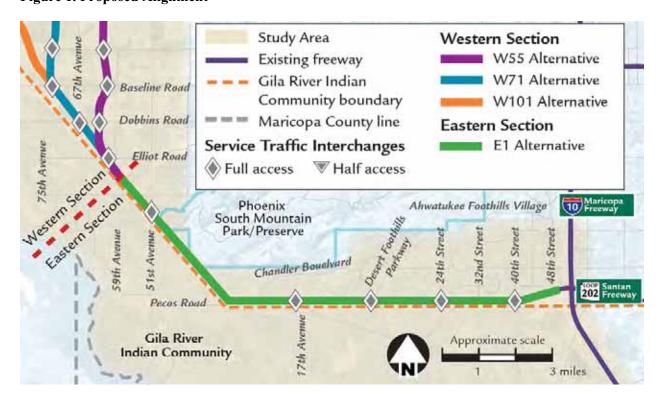
The E1 Alternative, shown in Figure 1, is currently the only action alternative being considered in the Eastern Section. In general, it would:

- connect the existing I-10/Loop 202/Pecos Road system traffic interchange in the east to the action alternatives in the Western Section.
- proceed west, replacing Pecos Road (through the southern edge of Ahwatukee Foothills Village), then diagonally through Phoenix South Mountain Park/Preserve (adjacent to the Gila River Indian Community).

Memorandum Purpose

Alternative profile designs for the E1 Alternative along the east-west portion of the alignment were studied to determine what impacts would result if the freeway were aboveground or went below ground. This technical memorandum summary presents existing conditions and the future conditions with the freeway aboveground or belowground. The evaluation presents impacts on the natural environment and adjacent residential areas, as well as presents preliminary cost estimates for each profile option.

Figure 1. Proposed Alignment



1



Technical Memorandum Summary E1 Alternative Initial Screening Profile Options Along Pecos Road Section

EXISTING CONDITIONS

Description

Currently, Pecos Road connects to I-10 and Loop 202 (Santan Freeway) on the east and continues west along the southern edge of Ahwatukee Foothills Village just north of the Gila River Indian Community boundary. Figure 2 displays the typical roadwaydevelopment context along Pecos Road. It is a 4-lane road with a divided, landscaped median. South of Pecos Road, there is a 100-foot major utility corridor that contains SRP overhead power lines. In most locations, there is undeveloped land between Pecos Road and the residential developments to the north.

Figure 2. Existing Conditions along Pecos Road



The undeveloped land is generally disturbed bare ground, varying in width. Almost all of the area north of the undeveloped land is fully developed with residential neighborhoods. The exception is between 17th Avenue and Chandler Boulevard, where the Arizona State Land Department owns a large undisturbed land parcel.

Pecos Road's profile generally follows the existing grade and has at-grade intersections with 40th Street, 32nd Street, 24th Street, Desert Foothills Parkway, 17th Avenue, and Chandler Boulevard. Between 24th Street and 17th Avenue, Pecos Road cuts through the South Mountains foothills.

Design Elements

Drainage

The City of Phoenix requires that major arterials be designed so that one 12-foot lane in each direction is free of runoff during a 2-year storm. The existing roadway uses the adjacent undeveloped land north of Pecos Road for retention and both drainage channels and natural washes to convey water to a series of culverts that carry the water under the roadway. In all, there are 35 culverts along Pecos Road in the following locations:

- 1 culvert is located between I-10 and 40th Street
- 1 culvert is located between 40th Street and 32nd Street
- 4 culverts are located between 32nd Street and 24th Street
- 5 culverts are located between 24th Street and Desert Foothills Parkway
- 9 culverts are located between Desert Foothills Parkway and 17th Avenue
- 15 culverts are located between 17th Avenue and Chandler Boulevard



Technical Memorandum Summary E1 Alternative Initial Screening Profile Options Along Pecos Road Section

South of Pecos Road, there are spreader basins within the utility corridor that turn the concentrated flow coming from the culverts into sheet flow prior to the water crossing the Community boundary. The conversion to sheet flow is done to reduce the impact on Community land.

During heavy storms, water pools upstream of the major culverts, usually in fields or undeveloped land located along Pecos Road. The major constraint of the current system is the amount of water allowed to flow into the Community. Without additional water conveyance improvements on Community land, the flow from north of Pecos Road would not be allowed to increase.

Transportation Use

Pecos Road serves as a major east-west arterial within the local grid system serving the southern portion of Ahwatukee Foothills Village. At the present time, it provides the lone access road to developments west of 17th Avenue.

FUTURE CONDITIONS: FREEWAY ABOVE EXISTING GROUND

Description

For the Freeway Above Existing Ground Option, the profile would be as close as possible to the existing grade except where it crosses major drainage structures and major arterial streets. At these locations, the profile would rise above the existing ground by as much as 30 feet.

To construct the freeway main line and service traffic interchanges, Pecos Road would be removed and all of the adjacent undeveloped land would be used. In some areas, the freeway would encroach on existing residential areas to the north. The freeway would not encroach on the existing utility corridor (relocation of the SRP overhead power line was reviewed and determined to not be prudent). The typical section includes the ultimate ten-lane freeway with standard cut and fill slopes and a parallel drainage channel located north of the freeway lanes.

Design Elements

Drainage

For aboveground portions of freeways, ADOT requires that the freeway infrastructure be designed to convey a 50-year storm for runoff upstream of the freeway (off-site) and for a 10-year storm for runoff within the freeway right-of-way (on site).

For the Freeway Above Existing Ground Option, the drainage plan would collect off-site flow in a parallel drainage channel corridor north of the freeway lanes and allow the water to flow under the freeway at existing crossing locations. Existing culverts and pipes would be replaced or extended as needed. Adequate channel width would be provided to ensure that the flow to the south of the freeway would not exceed existing conditions. Storm drain pipes would be used to collect on-site water and move it to the existing culverts and spreader basins south of the freeway.

Utilities

The existing City of Phoenix right-of-way for Pecos Road has water, sewer and gas lines. These utilities, mostly located beneath the existing pavement, would need to be relocated north of the freeway lanes



Technical Memorandum Summary E1 Alternative Initial Screening Profile Options Along Pecos Road Section

within the drainage channel corridor. This is a typical ADOT action that would be conducted to provide easier access to the utilities after the freeway were constructed.

Transportation Use

During construction, where possible, methods would be used to limit the impact to the current access and circulation provided by Pecos Road. Once complete, the freeway would be connected to the street network by providing access points at major arterials (currently planned for at 40th Street, 24th Street, Desert Foothills Parkway, and 17th Avenue). Other arterials would be allowed either to pass under the freeway (32nd Street) or be cut off by the freeway (Chandler Boulevard).

Potential Impacts

Distinguishing impacts associated with the Freeway Above Existing Ground Option are summarized in this section. The impacts presented would occur for the entire E1 Alternative, not just the portion that would run along Pecos Road.

Displacements

The Freeway Above Existing Ground Option would potentially displace 317 residences, including existing single family, multifamily, and manufactured homes, as well as platted lots. The option would not displace any businesses.

Cost

The Freeway Above Existing Ground Option (entire length, not just along Pecos Road) is estimated to cost \$810 million. The construction cost would be \$478 million, while the right-of-way cost would be \$332 million.

Noise

Noise impacts would be mitigated based on FHWA's Noise Abatement Criteria and ADOT's Noise Abatement Policy. It is anticipated that noise barriers would be used along the Pecos Road section. The probable size and location of potential noise barriers would be evaluated during the EIS process.

FUTURE CONDITIONS: FREEWAY BELOW EXISTING GROUND

Description

For the Freeway Below Existing Ground Option, the profile would remain below the existing ground at a varying depth for almost the entire length between 40th Street and approximately 35th Avenue (west of Chandler Boulevard). Typical depths could be between 20 and 30 feet. Because of the South Mountains foothills located near Desert Foothills Parkway, the freeway would need to be above existing ground for approximately 1 mile to keep its cut slopes from crossing into the Gila River Indian Community. The freeway could remain below the existing ground through this area, but it would require the freeway to be shifted to the north adding a substantial number of additional impacts.

To construct the freeway main line and service interchanges, Pecos Road would be removed and all of the undeveloped land would be used. In some areas, the freeway would encroach on existing residential areas to the north. The freeway would not encroach on the existing utility corridor (relocation of the SRP)



Technical Memorandum Summary E1 Alternative Initial Screening Profile Options Along Pecos Road Section

overhead power line was reviewed and determined to not be prudent and feasible). The typical section includes the ultimate ten-lane freeway with standard cut and fill slopes.

Design Elements

Retaining Walls

Retaining walls could be used north and south of the freeway lanes to reduce the width required by the side slopes of the freeway below existing grade.

Drainage

For a freeway belowground, ADOT requires that freeway infrastructure be designed to convey a 50-year storm for runoff upstream of the freeway and a 50-year storm for runoff within the freeway right-of-way. The requirements for on site water are increased for a freeway belowground because of an increased risk of flooding attributable to stormwater needing to be pumped out of the freeway belowground section.

To develop the design for the Freeway Below Existing Ground Option, the team started with what ADOT considers a typical drainage plan including detention basins near major outflow areas and a parallel channel corridor north of the freeway lanes. Up to six pump stations would be located along the corridor, one at each major detention basin, and the flow of water would travel under the freeway lanes. Similar systems have been successfully applied to I-10 (Papago Freeway) and Loop 202 (Santan Freeway). Detention basins are necessary because the amount of water to be conveyed would be greater for the Freeway Below Existing Ground Option and the number of crossings would be reduced, while the rate of water flow of the individual crossing must remain the same.

The location and size of the proposed detention basins are:

- 26-acre detention basin located north of the freeway and east of 40th Street
- 26-acre detention basin located north of the freeway between the 40th Street park and ride lot and Kyrene de Los Lagos Elementary School
- 10-acre detention basin located north of the freeway between 32nd Street and an existing channel
- 23-acre detention basin located north of the freeway just east of 24th Street
- 20-acre detention basin located north of the freeway between Desert Foothills Parkway and 17th Avenue adjacent to existing golf course outfall
- 38-acre detention basin located north of the freeway between 17th Avenue and Chandler Boulevard

After assessing the "typical" design and the impacts it might generate, the team looked at other design features, or options, to try to reduce impacts of a belowground condition. Such options included using wider linear channels instead of detention basins, using underground storage cells instead of detention basins, using detention basins located well upstream of the freeway instead of adjacent to the freeway, and using overhead channels and flumes instead of pumping under the freeway.

The use of wider linear channels instead of detention basins was eliminated from consideration because schools located adjacent to the freeway between 40th Street and 24th Street would be adversely affected by



Technical Memorandum Summary E1 Alternative Initial Screening Profile Options Along Pecos Road Section

wider linear channels. As possible, the detention basins west of Desert Foothills Parkway would generally be long and narrow.

Incorporating underground storage cells resulted in a reduction of the size of the detention basins. It was not possible to totally eliminate the need for detention basins. Maintenance would be complicated because the depth and length of the cells would make it difficult to gain access to the facilities for cleaning and general maintenance, and the enclosed areas would be governed by "confined space" regulations requiring air tanks for any maintenance personnel entering the cells. Provisions for allowing a bobcat-type machine to enter the cells would need to be incorporated into the design. Liability and security issues would arise from the possibility of humans and wildlife entering the culverts. Reductions in the number and size of detention basins would reduce right-of-way cost and residential displacements. However, the construction and maintenance cost of the underground storage cells would be greater than savings from the reduced right-of-way. Additional cost, maintenance, and safety issues make this option undesirable.

In addition to detention basins near the freeway, the amount of water crossing the freeway could be reduced by building new—or improving existing—off-site basins upstream (north) of the freeway. Improvement sites include but are not limited to existing golf courses, school fields, undeveloped land, and water features. The impacts associated with off-site detention basins were not considered in this analysis. Off-site detention basins would continue to be an option if found to be more suitable later in the design process.

Another option for passing runoff across the freeway would be to build channels (similar to an open canal) or flumes (multiple smaller pipes) to carry water over the freeway. A benefit of this system would be that maintenance would be much easier than a system that has the water going below the freeway. A channel would require a structure similar to a bridge at each crossing location. The freeway would need to be lower to allow for the required vertical clearance under structures. Flumes would be located at each existing crossing location instead of at concentrated areas. As with the channel, the freeway would need to be lower to allow for the required vertical clearance under the conveyance system. It is not anticipated that this option would reduce the size of the detention basins or remove the need for pump stations or retaining walls, and it would increase the depth of the freeway; therefore, this option was not carried forward for further study.

Utilities

The existing City of Phoenix right-of-way for Pecos Road has water, sewer and gas lines. These utilities, mostly located beneath the existing pavement, would need to be relocated north of the freeway lanes within the drainage channel corridor. This is a typical ADOT action that would be conducted to provide easier access to the utilities after the freeway were constructed.

Transportation Use

During construction, where possible, methods would be used to limit the impact to the current access and circulation provided by Pecos Road. Once complete, the freeway would be connected to the street network by providing access points at major arterials (currently planned for at 40th Street, 24th Street, Desert Foothills Parkway, and 17th Avenue). Other arterials would be allowed either to pass over the freeway (32nd Street) or be cut off by the freeway (Chandler Boulevard).



Technical Memorandum Summary E1 Alternative Initial Screening Profile Options Along Pecos Road Section

Potential Impacts

Distinguishing impacts associated with the Freeway Below Existing Ground Option are summarized in the following section. The impacts presented would occur for the entire E1 Alternative, not just the portion that would run along Pecos Road.

Displacements

The Freeway Below Existing Ground Option would potentially displace 616 residences (299 more than the Freeway Above Existing Ground Option), including existing single family, multifamily, and manufactured homes as well as platted lots. The option would not displace any businesses.

The use of underground storage cells would reduce the number of residential displacements to 491, approximately 125 fewer homes when compared with the impacts of the typical drainage plan for the Freeway Below Existing Ground Alternative.

Cost

The Freeway Below Existing Ground Alternative (entire length, not just along Pecos Road) is estimated to cost \$1.233 billion, which is \$423 million more than the Freeway Above Existing Ground Alternative. The construction cost would be \$517 million, while the right-of-way cost would be \$716 million.

The use of underground storage cells would increase the total estimated cost to \$1.261 billion. The construction cost would increase to \$758 million, while the right-of-way cost would decrease to \$503 million. The maintenance cost would be in addition to the construction cost presented.

Noise

Noise impacts would be mitigated based on FHWA's Noise Abatement Criteria and ADOT's Noise Abatement Policy. It is anticipated that noise barriers would be used along the Pecos Road section. The probable size and location of potential noise barriers would be evaluated during the EIS process. It can be expected that the size and location of the noise barriers would be similar to those for the Freeway Above Existing Ground Alternative.



Technical Memorandum Summary E1 Alternative Initial Screening Profile Options Along Pecos Road Section

SUMMARY AND CONCLUSION

Distinguishing impacts associated with the two profile options for the E1 Alternative along the Pecos Road section are summarized in Table 1.

Table 1. Summary of Impacts for Profile Options along Pecos Road					
Issue	Freeway Above Existing Ground Option	Freeway Below Existing Ground Option	Notes and Comments		
Residential Displacements	317	616 with base drainage plan; 491 with underground storage cells	Up to 150 additional acres would be required for the freeway belowground, displacing between 174 and 299 additional residences.		
Cost	\$810 million	\$1.233 billion with basic drainage plan; \$1.261 billion with underground storage cells	The pump stations, detention basins, and possible underground storage cells associated with the Freeway Below Existing Ground Option would result in additional maintenance cost for the life of the facility.		
Noise	Noise barriers would be used to mitigate impacts	Noise barriers would be used to mitigate impacts	The noise mitigation would be similar in nature for both profile options.		

The most common comment received from members of the public regarding the profile options along the Pecos Road section was that the belowground options would reduce noise and visual impacts. In examining the effectiveness of reducing impacts through depressing the freeway, ADOT would be required to spend an additional \$400 million for construction and right-of-way, displace an additional 300 residences, maintain additional pump stations and detention basins for the life of the freeway, and would still have noise-related impacts requiring mitigation. Noise barriers associated with either profile option would alter the views from Ahwatukee Foothills Village looking south. The Freeway Below Existing Ground Option would not result in the outcome that the public commenters anticipate and would result in substantially greater cost and displacements; therefore, the option was eliminated from further study.



Technical Memorandum Summary E1 Alternative Initial Screening Profile Options at the South Mountains' Ridges

INTRODUCTION

E1 Alternative Description

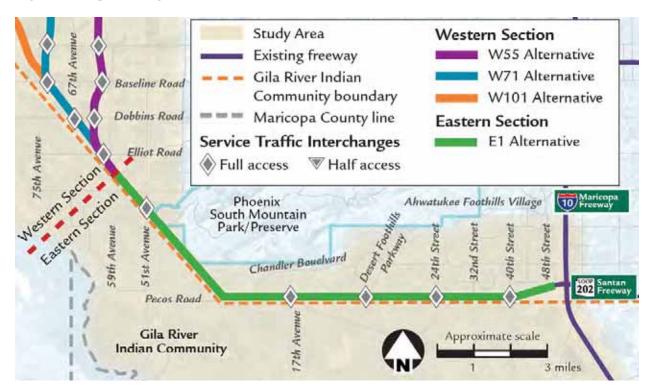
The E1 Alternative, shown in Figure 1, is currently the only action alternative being considered in the Eastern Section (see the *E1 Alternative Initial Screening Technical Memorandum Summary* for details regarding other alternatives considered but eliminated from further study). In general, it would:

- connect the existing I-10/Loop 202/Pecos Road system traffic interchange in the east to the action alternatives in the Western Section.
- proceed west, replacing Pecos Road (through the southern edge of Ahwatukee Foothills Village), then diagonally through Phoenix South Mountain Park/Preserve (adjacent to the Gila River Indian Community).

Memorandum Purpose

The E1 Alternative would result in direct use of resources associated with the South Mountains. The protected resources include the public parkland associated with the Phoenix South Mountain Park/Preserve, the historic nature of the mountains and parkland, and the cultural significance of the mountains. This memorandum presents the impacts associated with the proposed alternative as well as the design options considered but eliminated from further study.

Figure 1. Proposed Alignment



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PROPOSED E1 ALTERNATIVE

Description

The current proposed profile through the South Mountains, shown in Figure 2, would follow existing ground except where cuts to the hillsides would be needed to pass through the ridgelines. Figure 3 presents two simulations of what the cuts might look like through the ridgelines

Design Elements

Cut Sections

The width of the cut sections has been minimized to reduce the right-of-way needed. As shown in Figure 4, the typical section through the mountain ridges includes a rockfall containment ditch and assumes that cut slopes of up to $\frac{3}{4}$:1 could be attained. The actual constructed slopes would depend on the geotechnical constraints encountered during construction.

Potential Impacts

Landscape alteration

The proposed action would cut into three mountain ridges (two of which are located in Phoenix South Mountain Park/Preserve). The cuts could create substantial visual scars by replacing a natural setting with unweathered subsurface rock exposure. Mitigation measures would be used by ADOT to minimize the impacts of the cuts.

Intrusion

The proposed E1 Alternative would introduce an intensive man-made use into an otherwise passive, natural setting as evidenced by the remainder of Phoenix South Mountain Park/Preserve to the north and Community land to the south.

Access

The proposed E1 Alternative could alter access to Phoenix South Mountain Park/Preserve. While there are no formal trailheads or staging areas for access into the park where the proposed action would pass through the park, hikers, equestrian users, and Community members would have uncontrolled, casual access to the park in the affected area.

Habitat connectivity

While the Study Area is urbanizing and no documented major wildlife dispersal/migration routes exist, there is a continued interest from the commenting public, park/preserve stakeholders, and state and federal agencies to address habitat connectivity. Unmitigated, the possibility remains that the proposed action could create a physical impediment for the movement of wildlife to and from the Sierra Estrella, the Gila River lowlands, and the South Mountains.

Safety

Rockfall containment facilities would be provided through the ridges of the South Mountains.



Figure 2. E1 Alternative Profile

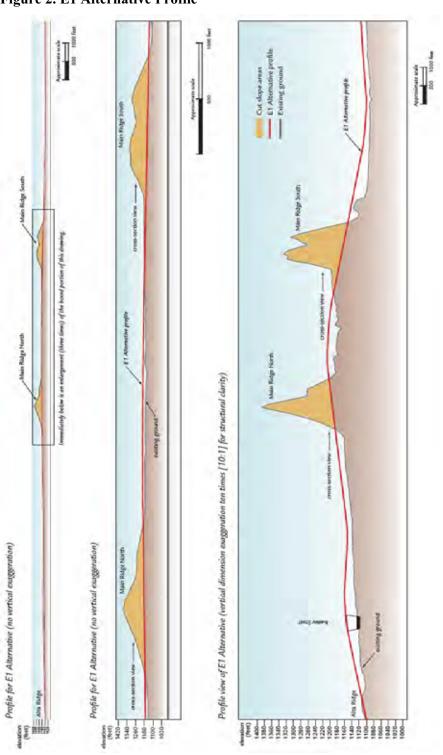




Figure 3. Photo simulation of cuts through South Mountains' Ridges

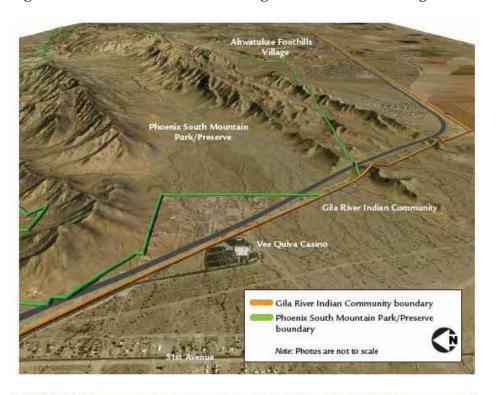
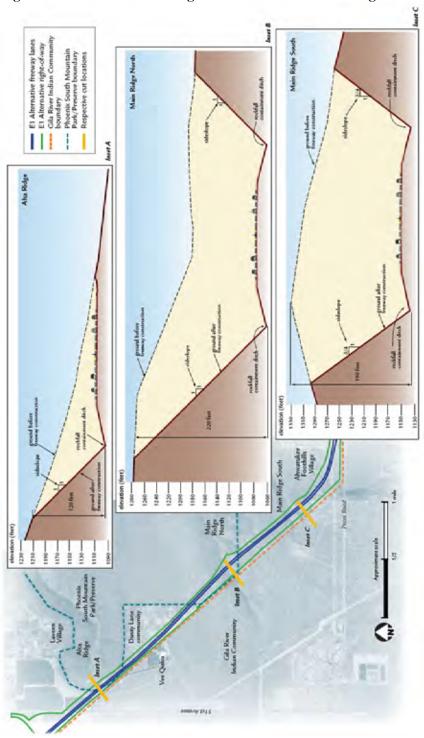






Figure 4. Cross sections through the South Mountains' Ridges





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Homeland security

There is no known abnormally high risk to homeland security from the proposed profile and cut sections through the South Mountains.

Hazardous material transport

It is anticipated that there would be no restrictions on the transport of hazardous materials along the E1 Alternative. Consideration would be given to transport of hazardous materials given that topography of the area would tend to cause any spills to flow immediately onto the Gila River Indian Community, unless a drainage containment system were used.

Cost

The E1 Alternative (entire length, not just through the South Mountains) is estimated to cost \$810 million. The construction cost would be \$478 million, while the right-of-way cost would be \$332 million.

Potential Mitigation

Wildlife crossings

While there are no known migration corridors, ADOT believes it is an important issue. As such, ADOT has proposed to construct multipurpose bridge structures in lieu of concrete box culverts at strategic locations along the E1 Alternative to improve habitat connectivity and provide equestrian, public, and other access points.

Cut slope treatments

ADOT would blend the appearance of the cuts through mountain ridgelines with the surrounding natural environment as would be feasible. The degree of slope treatment would depend on the interaction of the following factors:

- the angle of the cut slope and geological conditions
- the receptivity of the cut rock would to sculpting and rounding to mimic existing contours and allow for staining, revegetation, and other related measures



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BRIDGE ALTERNATIVES CONSIDERED BUT ELIMINATED

Description

To avoid or minimize impacts to the South Mountains, alternatives that would bridge either over the ridges or above the majority of the ridges were evaluated.

Design Elements

Profile

Two profile options, shown in Figures 5 and 6, through the South Mountains' ridges were developed for the bridge alternative. They include a high profile that goes over both ridge lines, approximately 200 feet above existing ground, and a medium profile that goes half-way up the ridge lines, approximately 100 feet above existing ground.

The maximum permissible grade based on ADOT *Roadway Design Guidelines* for a freeway facility is 3 percent. This constraint determined the linear extent of an inclined freeway needed to ascend or descend from the ridges.

Depth of Embankment

In coordination with ADOT Valley Project Management and ADOT District Maintenance, it was determined that 40 feet was the highest that the freeway could remain on dirt embankment. At heights greater than 40 feet, the freeway would need to be on a bridge structure. This constraint determined where the bridge piers would begin and end.

Potential Impacts

Landscape alteration

Vegetation would be maintained in the areas under the bridges. Vegetation would be lost in the areas where permanent improvements are made, such as freeway embankment and bridge piers. The medium profile option would also result in the removal of the ridges in open cut.

Visual

The bridge alternatives would increase visual impacts for views from the South Mountains to adjacent land and from adjacent land to the South Mountains.

As the medium profile option would pass out of the ridges in both the northwest and southeast, the freeway would be elevated approximately 50 feet above existing ground, fully visible to the residences in the Dusty Lane community, Ahwatukee Foothills Village, Laveen Village, and Gila River Indian Community. Cut slopes through the ridges could have slope treatment applied to better blend with the surrounding area. Vegetation would be used on all exposed ground surfaces. However, the open cut sections would disrupt the natural appearance of the existing ridges.

As the high profile option would pass over the ridges in both the northwest and southeast, the freeway would be elevated approximately 150 feet above existing ground, fully visible to the residences in the Dusty Lane community, Ahwatukee Foothills Village, and Gila River Indian Community. The freeway would be elevated above existing ground from approximately 51st Avenue to 25th Avenue. The high profile option would not result in cut slopes.



Figure 5. Bridge Alternative – High Profile Option

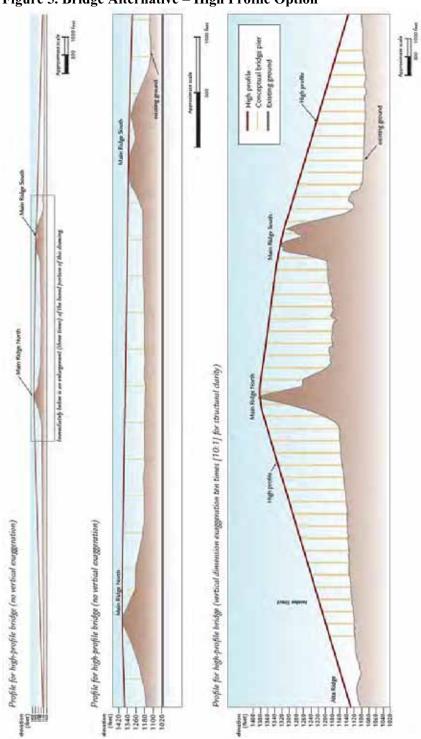
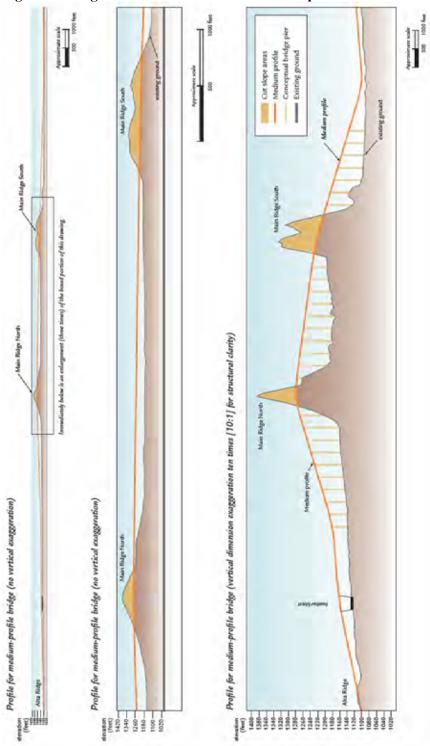




Figure 6. Bridge Alternative – Medium Profile Option





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Intrusion

Construction of the bridge alternatives would require drilling and blasting for the numerous pier foundations, which would result in permanent scarring and excavation of the ridges.

Access

Access to the South Mountains would be maintained in the areas where bridge structures would be used to approach the ridge crossings.

Habitat connectivity

Wildlife connectivity would be maintained in the areas where bridge structures would be used to approach the ridge crossings.

Safety

The medium-profile option would require rockfall containment facilities in the roadway cross section through the cut sections

Incident management would be constrained on the bridge alternatives because of the height above existing ground, lack of a graded side-slope, and the distance between freeway access points.

Continuous maximum grades of this length would be unique to an urban freeway in the Phoenix area.

Homeland security

Based on previous threats around the nation, the potential exists that a bridge of this length and height on a regional freeway system could become a terrorist target.

Hazardous material transport

Consideration would be given to transport of hazardous materials across the medium-profile and high-profile bridges, given that topography of the area would tend to cause any spills to flow immediately onto the Gila River Indian Community, unless a drainage containment system were used.

Cost

The bridge alternatives would cost approximately \$212 million and \$265 million more than the proposed E1 Alternative for the medium-profile and high-profile options, respectively. The increased cost would be entirely attributable to construction cost.

Conclusion

Based on costs of extraordinary magnitude and the inability to avoid direct use (and direct use-related impacts) of the resources associated with the South Mountains, the bridge alternatives would not be prudent and feasible and were, therefore, eliminated from further consideration.



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TUNNEL ALTERNATIVES CONSIDERED BUT ELIMINATED

Description

In response to concerns regarding the impacts of the Proposed E1 Alternative, design options to tunnel through the South Mountains were examined.

Design Elements

Profile

Three profile options through the ridges of South Mountains were developed for the tunnel alternative. They included an underground profile that goes approximately 60 feet below existing ground for approximately 1.6 mile; a low profile which generally follows the same elevation as the proposed E1 Alternative, resulting in two 1,000-foot-long tunnels; and a medium profile that is the same as the medium profile for the bridge alternative but instead of an open cut through the ridges would result in two 500-foot-long tunnels through the ridges. Figure 7 presents each option.

The same constraints as employed with the bridge alternatives with regard to maximum grades and maximum embankment heights were applied to this alternative.

Tunnel Engineering

As background information, the appearance of a freeway tunnel system is generally controlled by technical considerations:

- A tunnel's dimensions and its distance below ground are determined by existing geological conditions and available construction technology. When coupled with appropriate safety considerations, these factors basically determine a single tunnel's size or tunnel conditions.
- Once geologic and construction capabilities are determined, operational needs are considered, including the number of lanes, safe sight distances and other safety features, ventilation features, maintenance features, and security issues. These considerations are used to determine whether the operational needs can be met with the tunnel conditions outlined or if more than one tunnel (located adjacent to each other) would be needed.
- Finally, it is necessary to determine whether the tunnel(s) would be sufficiently deep and long to avoid or reduce impacts on the surrounding environment. When considered together, these factors help determine the minimum acceptable tunnel dimensions (height and width), distance below ground, number of adjacent tunnels to accommodate all of the freeway lanes, tunnel length and location, and possible construction techniques.

Tunneling options were assessed to determine the feasibility of their construction and maintenance, to determine their effectiveness in avoiding or reducing impacts to the South Mountains, and to assess whether tunneling through the mountain range would generate other desirable or undesirable outcomes.

Constructibility

The tunnel evaluation included investigation of current methods for constructing the tunnel. The two potential methods were 1) use of the traditional boring method or 2) use of the sequential excavation method (SEM; also known as the New Austrian Tunneling Method [NATM]). The boring method uses a boring machine built to the size of the desired tunnel to drill through the mountain. The SEM uses



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traditional machinery to excavate rock in 2- to 3-foot increments. The SEM is more cost-effective and is able to produce wider tunnel sections than the boring method.

The proposed freeway would ultimately need to be ten lanes to accommodate design year (2030) traffic. In an ideal situation, all lanes of traffic moving in one direction would be in one tunnel. This would result in two tunnels, each approximately 104 feet wide (width would entail five 12-foot lanes, two 12-foot shoulders, and two 10-foot emergency walkways). The next most appropriate option—minimally acceptable—would have high-occupancy-vehicle (HOV) traffic for both directions using a separate, approximately 92-foot-wide tunnel (the HOV tunnel would have two 12-foot lanes, four 12-foot shoulders, and two 10-foot emergency walkways) and two similarly sized tunnels for general purpose traffic (the general purpose tunnels would have four 12-foot lanes, two 12-foot shoulders, and two 10-foot emergency walkways). Neither of these options would be possible to construct with current technology. To date, the widest tunnel excavations in the United States have been 70 feet, about 22 feet narrower than would be necessary for the minimally acceptable option.

The only option that appears constructible using current technology would be to use four tunnels, splitting traffic going in the same direction. Two of the four tunnels would require an 80-foot width, 10 feet wider than the currently constructed tunnels noted above. The ideal, minimally acceptable, and constructible tunnel configurations are presented in Figure 8. Because of the variable nature of the site-specific geology (including dangers that could arise from encountering fractured rock), it is not possible at this time to determine specific dimensions of a maximum feasible tunnel width.

Both ADOT and FHWA believe that an 80-foot tunnel option would result in unacceptable safety concerns, because of diverging traffic and increased constructibility challenges.

Potential Impacts

Landscape alteration

The tunnel alternatives would maintain existing vegetation through the limits of the tunnel segments. Permanent scarring of existing vegetation would occur at the approaches to the portal openings for all three profile options (see Figure 9).

Visual

With the exception of the portals, tunnel alternatives would remove the freeway from view in the vicinity of the mountain ridges.

The construction of the portals for all of the tunnels would result in scarring to the ridges. These disturbed areas could have slope treatment applied as well as vegetation to better blend with the surrounding areas.

Ventilation locations, maintenance facilities, and access roads would be required and could adversely affect the visual setting of the ridges.

The bridge structures associated with the medium profile would increase the visual impacts. As the medium-profile option passes out of the ridges in both the northwest and southeast, the freeway would be elevated approximately 50 feet above existing ground, fully visible to the residences in the Dusty Lane community, Ahwatukee Foothills Village, and Gila River Indian Community.



Figure 7. Tunnel Profile Options

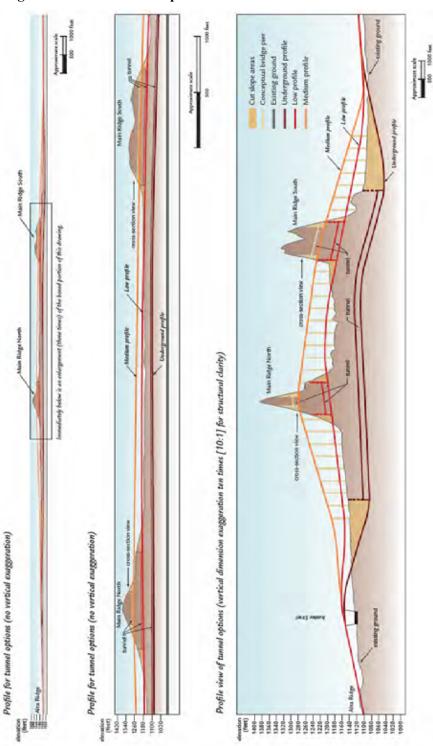
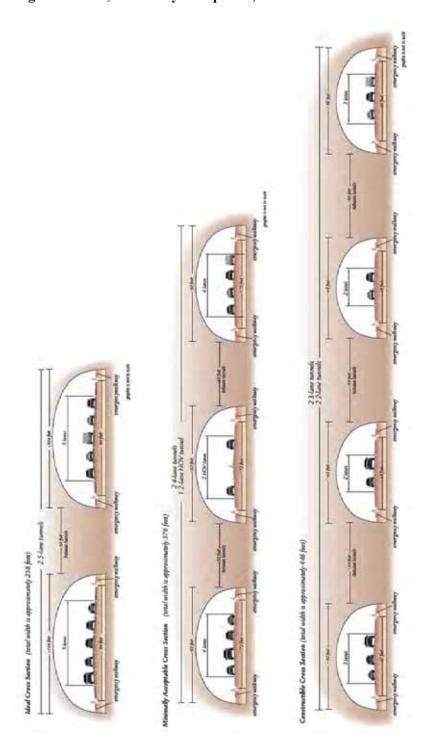




Figure 8. Ideal, Minimally Acceptable, and Constructible Tunnel Cross Sections





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Figure 9. Photo Simulation of Tunnel – Low Profile Option



Intrusion

Construction of the tunnel alternatives would require drilling and blasting for tunnel portals, which would result in permanent scarring and excavation of the ridges. Ventilation locations, maintenance facilities, and access roads would also result in permanent scarring.

Construction of the bridge structures associated with the medium profile option would require drilling and blasting for numerous pier foundations, which would result in permanent scarring and excavation of the ridges.

Access

Access to the South Mountains would be maintained within the limits of the tunnel sections for any of the profile options. The bridge structures associated with the medium-profile option would provide additional access opportunities.



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Habitat connectivity

Habitat connectivity would be maintained within the limits of the tunnel sections for any of the profile options. The bridge structures associated with the medium-profile option would provide additional access opportunities.

Safety

The tunnel options would create undesirable safety issues. Emergencies would result in complex response planning for traffic control, fire detection, ventilation and exhaust, and fire safety systems. Traffic operation would be affected by the splitting of lanes into different tunnels.

Homeland security

Tunnels on a metropolitan freeway system are being recognized by the Department of Homeland Security as potential terrorist targets.

Hazardous material transport

ADOT would evaluate the transport of hazardous materials based on the length of the tunnels and the location of alternative routes. They could prohibit the transport of hazardous materials through any of the tunnel options. In that case, vehicles transporting hazardous materials would need to use alternative routes, either I-17 through downtown Phoenix or surface streets on the Gila River Indian Community or within the City of Phoenix.

Cost

Relative to the proposed E1 Alternative, use of the SEM to construct the tunnel alternative would cost an additional \$1.101 billion for the underground profile option, \$236 million for the low-profile option, and \$246 million for the medium-profile option.

Relative to the proposed E1 Alternative, use of the boring method to construct the tunnel alternative would cost an additional \$2.512 billion for the underground profile option, \$560 million for the low-profile option, and \$426 million for the medium-profile option.

Conclusion

Considering that current construction techniques do not allow for construction of tunnels that would meet the minimally acceptable characteristics and that tunnel options would not fully achieve the desired outcomes, ADOT and FHWA have determined the additional costs presented by tunnel options would not be warranted and, therefore, not justified. For these reasons tunnel alternatives were eliminated from further study.